(b) what exactly is bio-separation;

(c) whether any research is going on in the country on bio-separation; and

(d) if so, in what way it helps the common man?

THE MINISTER OF STATE IN THE MINISTRY OF SCIENCE AND TECHNOLOGY (SHRI KAPIL SIBAL): (a) Yes, Sir.

(b) Bio-separation is the process for purification of targeted bio-molecule by applying various techniques. Bio-molecules are usually present in very low concentrations. Further, the impurities could have physicochemical properties similar to those of the target compound of interest. Several separation steps are needed to obtain the target molecule sufficiently pure to make it suitable for a specific use. The primary downstream operation is the removal of insolubles (e.g. by sedimentation, filtration, centrifugation, permeation by membranes), followed by isolation of the compound (e.g. by precipitation, extraction, adsorption, separation by membranes) and final purification (e.g. by crystallization, chromatography).

(c) Yes, Sir.

(d) Bio-separation is useful for various biotechnological applications involving large scale purification and protein separation. It is one of the steps involved in the process for preparation of therapeutically important compounds, antibiotics, food supplements and enzymatic preparations. It also has application in water and air purification systems leading to reduction in environmental pollution.

Gene Silencing

1989. SHRI NANDI YELLAIAH: Will the Minister of SCIENCE AND TECHNOLOGY be pleased to state:

(a) whether Hyderabad based Centre for Cellular and Molecular Biology (C.C. M.B.) led by Manika Pal Bhadra and Utpal Bhadra under C.C.M.B., Director Shri Lalji Singh has unraveled the Mystery behind Gene Silencing paving the way for detecting the mechanisms that prevents cancer in human beings;

(b) if so, the details thereof;

(c) details of action taken so far in the direction of developing these new findings towards Pharmaceutical therapy for Patenting and marketing the product to save several millions of cancer victims in the world from death, every year;

(d) whether Government would assure of releasing special package of funds in this most important and crucial field of "Gene Silencing" for speedy results; and

(e) if not, the reasons therefor?

THE MINISTER OF STATE IN THE MINISTRY OF SCIENCE AND TECHNOLOGY (SHRI KAPIL SIBAL): (a) Yes, Sir.

(b) Dr. Manika Pal Bhadra and Utpal Bhadra first demonstrated that gene silencing is involved in heterochromatin which is required for rapid cell division; these results have already been published in the prestigious journal Science (2004). In continuation to their work they recently found that several microRNAs are involved in heterochromatin formation. Diseases coupled with cell division and cell proliferation, such as various types of Cancers, appear to be controlled by heterochromatin formation and its functioning. Understanding the role of gene silencing through microRNAs thus might pave a way to use it as a possible therapy for cancers and other related diseases, which involve cell cycle controls.

(c) and (d) Several measures are being taken in the direction of the development of therapy for cancer. Besides preparing a detailed progress report for the application of these results for cancer treatment Scientists at CCMB have also prepared a detailed document for patent application. The programme as part of R&D activity of CCMB is receiving necessary financial support.

(e) Question does not arise.

Change in calculation of time

†1990. SHRI BALAVANT *ALIAS* BAL APTE: Will the Minister of SCIENCE AND TECHNOLOGY be pleased to state:

(a) whether calculation of time has been changed in the Indian National Calendar;

†Original notice of the question was received in Hindi.